Laidlaw Programme Reflective Report

Scholar Report

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Title of Scholarship Project:	Embedding Sustainability in Engineering Education

In today's rapidly evolving world, the need for sustainability has become increasingly evident. Challenges such as climate change, resource depletion, social inequality, and poverty demand urgent attention and innovative solutions. Engineers, as problem solvers and innovators, have a crucial role to play in addressing these global issues. To equip the next generation of engineers with the knowledge and skills required to tackle these challenges head-on, it is imperative to integrate sustainability into engineering education. Therefore, to introduce my research project - 'Embedding sustainability in engineering education' which I completed under the supervision of Dr. Manoj Ravi at the School of Chemical and Process Engineering.

The goal of my research project is to implement the United Nations Sustainable Development Goals (SDGs) within engineering curricula, positioning sustainability as a fundamental element. This initiative aims to empower future engineers to leverage their expertise effectively in addressing global challenges related to sustainable development. Growing consensus is calling for the revamp of engineering education where sustainable development becomes the underpinning element. The objective of this research is to identify existing knowledge gaps and emerging trends in embedding sustainability in engineering education worldwide.

Using diverse methodologies, including literature analysis and surveying opinions in the education community, the findings of this research are aimed to help shape the design and delivery of a cutting-edge sustainable engineering curriculum.

The methodology I undertook to complete my research used Web of Science and involved analysing 265 documents meticulously. This process entailed reading through each document and categorizing them into subcategories to discern their primary focus. These subcategories encompassed identifying which United Nations Sustainable Development Goals (SDGs) were addressed, determining whether the authors were from a High-Income Country (HIC), Middle-Income Country (MIC), or Low-Income Country (LIC), as well as considering the geographic location of the country, the specific engineering disciplines emphasized, and whether the documents resulted from international collaborations. Furthermore, to ensure the relevance and specificity of the collected data, I established an exclusion criterion. This criterion was employed to filter out documents that did not directly pertain to the research topic, ensuring the precision of the analysis. The insights gained from this rigorous methodology have not only provided valuable information for this research but also hold the potential to influence the future of engineering education.

By understanding which SDGs are more prominently addressed and where geographic disparities exist, educators and institutions can tailor their curricula to better equip future engineers to address global challenges effectively. Through the visual presentation of data in various graphs and the ongoing process of transforming these findings into a professional document for publication, the research aims to contribute to the growing body of knowledge on embedding sustainability in engineering education. Ultimately, the aspiration is that this work will serve as a foundation for new discoveries and innovations, furthering the cause of sustainable engineering education worldwide.

Engineers play a critical role in finding solutions to these challenges, and incorporating sustainability into engineering education ensures that future engineers are equipped to contribute effectively. It aids in preparing future leaders as Engineering graduates often hold positions of influence in various industries. By educating them about sustainability principles and practices, we can prepare future leaders who prioritize environmentally and socially responsible decision-making. I hope that my research would help instil a sense of social responsibility in students worldwide. This includes considering the needs of marginalized communities, promoting equity, and addressing issues like access to clean water, energy, and healthcare, all of which are central to sustainability.

My research will increase interdisciplinary collaboration between engineers and experts from other disciplines, such as environmental science, social science, and policy to lead to holistic solutions to complex sustainability challenges. Improving the curriculum increases innovation and problem-solving as engineers are taught to think critically and creatively about these challenges which can lead to the development of groundbreaking technologies and approaches. A global perspective can be highlighted through education which helps engineers understand the global context of their work and consider cultural and environmental factors. It promotes ethical behaviour transparency, and accountability, which are crucial for building trust and ensuring that engineering projects benefit society as a whole.

By increasing the amount of collaboration between different universities and sectors such as industry and NGO and charities, through real life problem solving for engineers in their education will help bring the change needed in this world. The University's Sustainable Curriculum team is publishing student case studies on sustainability, so I wrote up an article on my experience with Laidlaw and how it helped me gain further knowledge and understanding of sustainability. I was further able to promote the opportunities Laidlaw has given me from the opportunity to publish and present my findings at the University of Leeds annual Sustainability Conference. I am very enthusiastic to promote the program as it has given me opportunities, I would have not been able to experience in any other circumstance.

Furthermore, I took part in the 'In2Science placement' where students were invited to do a Chemical Engineering Placement for a week, and I was lucky enough to present all my research to them and give them a better understanding of the topic and how a literature survey analysis can be completed successfully. In addition, I have discussed my project to other Laidlaw scholars from other universities and made links between our research projects, as well as been an active member of the Laidlaw Scholars Network where I post updates on my project and my findings.

This research project has allowed me to learn about programs such as 'Web of Science' and 'Google Scholar' and opened me up to all these new resources I previously had no knowledge of. Conducting this research has allowed me to increase my communication and confidence skills in speaking and writing, as I have had to reach out to professors from across the globe to have access to their research documents. I have largely improved my networking and collaboration skills as this research allowed me to build relationships with peers, mentors, and experts in the field which opened doors for personal and professional growth. Engaging in

this research lead to a deeper understanding of my values and ethics, as I gained a wider understanding of the topic at hand with many perspectives.

Personal Fulfilment was also a huge feeling I gained from achieving research goals and contributing my knowledge, bringing a sense of accomplishment. Since research involves evaluating sources, assessing evidence, and drawing conclusions based on data. This cultivated an increase in my critical thinking skills, which is valuable in everyday decision-making and problem-solving. I gained resilience as the research was challenging at times, with setbacks and failures at times. This helped me gain resilience, adaptability, and perseverance when faced with a challenge of data not following a pattern I expected or wanted. At first it caused frustration, but I learnt to overcome these issues and adapt to the new circumstances. This links to the next skill I gained from the research project which is self-discipline. The Research often required self-motivation and discipline to set goals, manage time, and stay focused on tasks. Developing these qualities was beneficial not only in research but in all aspects of life. My research project has allowed me to present my research findings clearly in front of an audience with confidence. These new communication skills have enhanced my ability to convey complex ideas clearly and persuasively, a skill applicable in various aspects of life.

Furthermore, I have been able to effectively communicate with my supervisor with weekly visits to keep up to date which the project and take any criticism or advice on board. As well as this, I have confidently talked about project to other Laidlaw scholars from other universities and made links between our research projects. I hope to present my work at the Sustainability Conference at the University of Leeds 2024 and am in the process of writing up my results for publication to be made aware to the rest of the educational system. I hope that my Research publications have the potential to influence future generations of researchers, serving as a foundation for new discoveries and innovations in the years to come. I hope that my findings can lead to practical solutions and improvements in the educational system when it comes to sustainability. I would hope that the publication has the potential to reach a global audience, making it possible for research to have a broad and meaningful impact on society, policy, and practice. Ideally, I would have the opportunity to collaborate with researchers of similar areas of research to lead to new insights and expand the research opportunities.

I have a strong and unwavering commitment to dedicating my career to the betterment of our planet. My aspirations as a Civil and Environmental Engineer extend far beyond the confines of traditional engineering roles. One of my primary goals is to collaborate with underserved communities in developing countries, where the need for quality sanitation and essential resources is critical. I am driven by the belief that engineering can play a pivotal role in improving the lives of those who lack access to basic necessities. In addition to my focus on sanitation and resource provision, I am deeply passionate about the development of new, sustainable energy solutions. As we confront the pressing challenges of climate change and environmental degradation, I see the urgency in revolutionizing our energy systems. To this end, I have already taken steps in this direction.

I designed a water purification model that employs UV light to effectively eliminate pathogens from stagnant water sources, rendering it safe for consumption. My ultimate vision is to scale up this innovation for mass production, ensuring that clean and potable water becomes accessible to people all over the world. Furthermore, I am committed to pioneering efficient renewable energy technologies that are accessible and require minimal energy for their construction and operation. The possibilities in this field are limitless. From harnessing the energy potential of algae through a hydrotreating refinery process to leveraging the power of water itself by separating hydrogen from oxygen using a water fuel cell, there exists a vast array of unconventional methods for energy production waiting to be explored and developed.

In my view, the convergence of engineering, sustainability, and global humanitarian efforts holds the key to a brighter and more sustainable future. By actively contributing to these areas, I aim not only to make a meaningful impact but also to inspire others to join the cause and drive innovation towards a more sustainable and equitable world for all.

Supervisor

Please comment on your scholar's research period, what you consider to be your scholars' strengths and which leadership attributes you feel your scholar has demonstrated and is particularly skilled in. You could also identify areas which your scholar can develop further.

Soluna was highly enthusiastic about the project and made very good progress on the project in the research period. She was systematic in structuring her work and meeting the project objectives. Her strong communication skills will hold her in good stead for leadership responsibilities.

Signature of Scholar S.S Date: 16/ 09 / 2023

Signature of Project Leader Manoj Ravi Date: 17/09/2023